

ATTACHMENT A

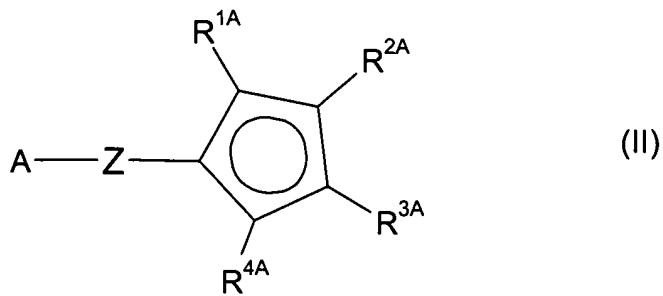
Claims 1 - 15: (Cancelled)

16. (New) A copolymer of ethylene with α -olefins which comprises a molar mass distribution M_w/M_n of from 1 to 8, a density of from 0.85 to 0.94 g/cm³, a molar mass M_n of from 10 000 g/mol to 4 000 000 g/mol, a CDBI of less than 50%, the copolymer comprising at least a bimodal short chain branching distribution, and wherein a side chain branching of the maxima of the individual peaks of the short chain branching distribution, as determined by crystallization analysis fractionation (CRYSTAF), of the copolymer of ethylene and the α -olefins is greater than 5 CH₃/1 000 carbon atoms.
17. (New) The copolymer of ethylene with α -olefins as claimed in claim 16, wherein the molar mass M_n is from 150 000 g/mol to 1 000 000 g/mol.
18. (New) The copolymer of ethylene with α -olefins as claimed in claim 16 which has at least one peak, as determined by CRYSTAF, of a differential distribution in the range from 15 to 40°C, and at least one further peak, as determined by CRYSTAF, of the differential distribution in the range from 25 to 80°C.
19. (New) The copolymer of ethylene with α -olefins as claimed in claim 16, wherein the copolymer of ethylene with α -olefins comprise a trimodal short chain branching distribution.

20. (New) A process for preparing ethylene copolymers comprising a molar mass distribution M_w/M_n of from 1 to 8, a density of from 0.85 to 0.94 g/cm³, a molar mass M_n of from 10 000 g/mol to 4 000 000 g/mol, a CDBI of less than 50%, the copolymer comprising at least a bimodal short chain branching distribution, and wherein a side chain branching of the maxima of the individual peaks of the short chain branching distribution, as determined by crystallization analysis fractionation (CRYSTAF), of the copolymer of ethylene and the α -olefins is greater than 5 CH₃/1 000 carbon atoms, the process comprising polymerizing ethylene with α -olefins in presence of the following components:

A) at least one monocyclopentadienyl complex comprising a structural feature of a formula (Cp-Z-A)Cr (I), where the variables have the following meanings:

Cp-Z-A is a ligand of the formula (II):

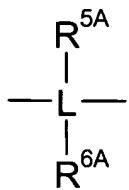


where

R^{1A}-R^{4A} are each, independently of one another, hydrogen, C₁-C₂₀-alkyl, C₂-C₂₀-alkenyl, C₆-C₂₀-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms

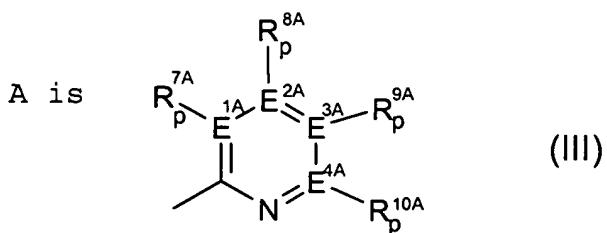
in the aryl part, NR^{11A}_2 , $\text{N}(\text{SiR}^{11A}_3)_2$, OR^{11A} , OSiR^{11A}_3 , SiR^{11A}_3 , BR^{11A}_2 , where the organic radicals $\text{R}^{1A}-\text{R}^{4A}$ may also be substituted by halogens and where at least two of the vicinal radicals $\text{R}^{1A}-\text{R}^{4A}$ are joined to form a five- or six-membered ring, and/or two vicinal radicals $\text{R}^{1A}-\text{R}^{4A}$ are joined to form a heterocycle which contains at least one atom from the group consisting of N, P, O and S;

Z is a bridge between A and Cp having the formula:



where

L is carbon or silicon,
 $\text{R}^{5A}, \text{R}^{6A}$ are each hydrogen, C_1-C_{20} -alkyl, C_2-C_{20} -alkenyl, C_6-C_{20} -aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{11A}_3 , where the organic radicals R^{5A} and R^{6A} may also be substituted by halogens and R^{5A} and R^{6A} may also be joined to form a five- or six-membered ring;



where

$E^{1A}-E^{4A}$ are each carbon or nitrogen,
 $R^{7A}-R^{10A}$ are each, independently of one another, hydrogen, C_1-C_{20} -alkyl, C_2-C_{20} -alkenyl, C_6-C_{20} -aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{11A}_3 , where the organic radicals $R^{7A}-R^{10A}$ may also bear halogens or nitrogen or further C_1-C_{20} -alkyl groups, C_2-C_{20} -alkenyl groups, C_6-C_{20} -aryl groups, alkylaryl groups having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{11A}_3 as substituents and two vicinal radicals $R^{7A}-R^{10A}$ or R^{7A} and Z may also be joined to form a five- or six-membered ring,

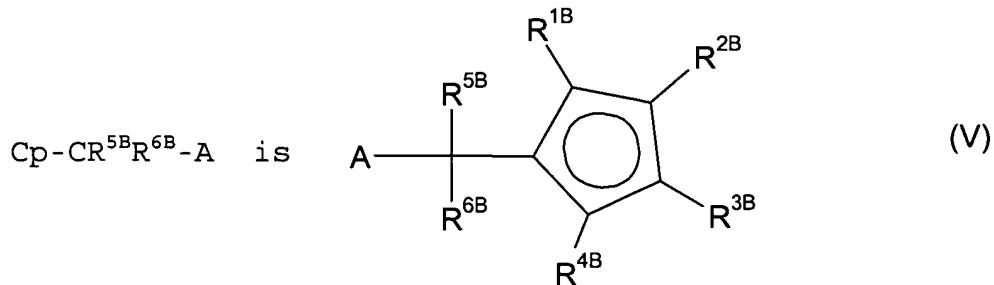
R^{11A} are each, independently of one another, hydrogen, C_1-C_{20} -alkyl, C_2-C_{20} -alkenyl, C_6-C_{20} -aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part and two geminal radicals R^{11A} may also be joined to form a five- or six-membered ring, and

p is 0 when $E^{1A}-E^{4A}$ is nitrogen and is 1 when $E^{1A}-E^{4A}$ is carbon;

- B) optionally an organic or inorganic support;
- C) optionally at least one activating compound; and
- D) optionally at least one metal compound containing a metal of group 1, 2 or 13 of the Periodic Table.

21. (New) A catalyst system for olefin polymerization comprising

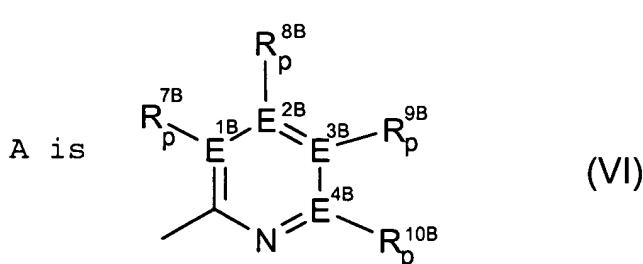
A') at least one monocyclopentadienyl complex A') comprising the structural feature of a formula ($Cp-CR^{5B}R^{6B}-A)Cr$ (IV), where the variables have the following meanings:



where

$R^{1B}-R^{4B}$ are each, independently of one another, hydrogen, C_1-C_{20} -alkyl, C_2-C_{20} -alkenyl, C_6-C_{20} -aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl radical and 6-20 carbon atoms in the aryl radical, NR^{5A}_2 , $N(SiR^{11B}_3)_2$, OR^{11B} , $OSiR^{11B}_3$, SiR^{11B}_3 , BR^{11B}_2 , where the organic radicals $R^{1B}-R^{4B}$ may also be substituted by halogens and two vicinal radicals $R^{1B}-R^{4B}$ may also be joined to form a five- or six-membered ring,

R^{5B}, R^{6B} are each hydrogen or methyl;



where

$E^{1B}-E^{4B}$ are each carbon or nitrogen,

$R^{7B}-R^{10B}$ are each, independently of one another, hydrogen, C_1-C_{20} -alkyl, C_2-C_{20} -alkenyl, C_6-C_{20} -aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{11B}_3 , where the organic radicals $R^{7B}-R^{10B}$ may also bear halogens or nitrogen or further C_1-C_{20} -alkyl groups, C_2-C_{20} -alkenyl groups, C_6-C_{20} -aryl groups, alkylaryl groups having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{11B}_3 as substituents and two vicinal radicals $R^{7B}-R^{10B}$ may also be joined to form a five- or six-membered ring,

R^{11B} are each, independently of one another, hydrogen, C_1-C_{20} -alkyl, C_2-C_{20} -alkenyl, C_6-C_{20} -aryl or alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part and two radicals R^{11B} may also be joined to form a five- or six-membered ring,

p is 0 when $E^{1B}-E^{4B}$ is nitrogen and is 1 when $E^{1B}-E^{4B}$ is carbon,

where at least one radical $R^{7B}-R^{10B}$ is C_1-C_{20} -alkyl, C_2-C_{20} -alkenyl, C_6-C_{20} -aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{11B}_3 and the organic radicals $R^{7B}-R^{10B}$ may also bear halogens or nitrogen or further C_1-C_{20} -alkyl groups, C_2-C_{20} -alkenyl groups, C_6-C_{20} -aryl groups, alkylaryl groups having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{5C}_3 , as substituents and

two vicinal radicals R^{7B} - R^{10B} may also be joined to form a five- or six-membered ring or at least one E^{1B} - E^{4B} is nitrogen;

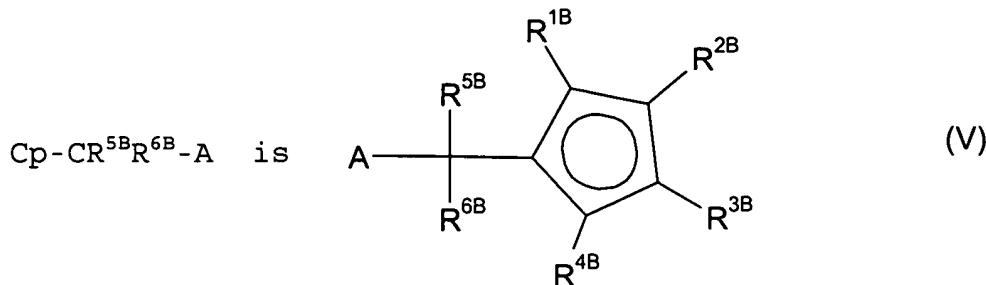
- B) optionally an organic or inorganic support;
- C) optionally at least one activating compound; and
- D) optionally at least one metal compound containing a metal of group 1, 2 or 13 of the Periodic Table,

wherein the catalyst system produces a copolymer of ethylene with α -olefins which comprises a molar mass distribution M_w/M_n of from 1 to 8, a density of from 0.85 to 0.94 g/cm³, a molar mass M_n of from 10 000 g/mol to 4 000 000 g/mol, a CDBI of less than 50%, the copolymer comprising at least a bimodal short chain branching distribution, and wherein a side chain branching of the maxima of the individual peaks of the short chain branching distribution, as determined by crystallization analysis fractionation (CRYSTAF), of the copolymer of ethylene and the α -olefins is greater than 5 CH₃/1 000 carbon atoms.

22. (New) The catalyst system for olefin polymerization as claimed in claim 21, wherein two vicinal radicals R^{1B} - R^{4B} in the monocyclopentadienyl complex A') form a fused ring system.

23. (New) A prepolymerized catalyst system comprising a catalyst system comprising:

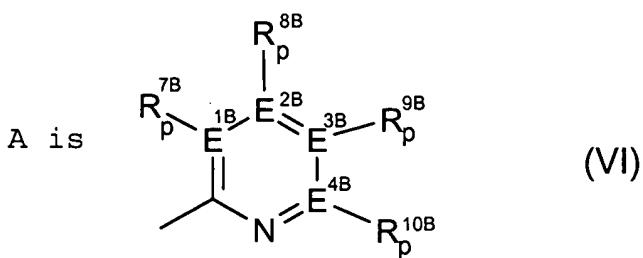
A') at least one monocyclopentadienyl complex A') comprising the structural feature of a formula (Cp-CR^{5B}R^{6B}-A)Cr (IV), where the variables have the following meanings:



where

$\text{R}^{1B}-\text{R}^{4B}$ are each, independently of one another, hydrogen, C_1-C_{20} -alkyl, C_2-C_{20} -alkenyl, C_6-C_{20} -aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl radical and 6-20 carbon atoms in the aryl radical, NR^{5A}_2 , $\text{N}(\text{SiR}^{11B}_3)_2$, OR^{11B} , OSiR^{11B}_3 , SiR^{11B}_3 , BR^{11B}_2 , where the organic radicals $\text{R}^{1B}-\text{R}^{4B}$ may also be substituted by halogens and two vicinal radicals $\text{R}^{1B}-\text{R}^{4B}$ may also be joined to form a five- or six-membered ring,

$\text{R}^{5B}, \text{R}^{6B}$ are each hydrogen or methyl;



where

$\text{E}^{1B}-\text{E}^{4B}$ are each carbon or nitrogen,

$\text{R}^{7B}-\text{R}^{10B}$ are each, independently of one another, hydrogen, C_1-C_{20} -alkyl, C_2-C_{20} -alkenyl, C_6-C_{20} -aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{11B}_3 , where the organic radicals $\text{R}^{7B}-\text{R}^{10B}$ may also bear

halogens or nitrogen or further C₁-C₂₀-alkyl groups, C₂-C₂₀-alkenyl groups, C₆-C₂₀-aryl groups, alkylaryl groups having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{11B}₃ as substituents and two vicinal radicals R^{7B}-R^{10B} may also be joined to form a five- or six-membered ring,

R^{11B} are each, independently of one another, hydrogen, C₁-C₂₀-alkyl, C₂-C₂₀-alkenyl, C₆-C₂₀-aryl or alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part and two radicals R^{11B} may also be joined to form a five- or six-membered ring,

p is 0 when E^{1B}-E^{4B} is nitrogen and is 1 when E^{1B}-E^{4B} is carbon,

where at least one radical R^{7B}-R^{10B} is C₁-C₂₀-alkyl, C₂-C₂₀-alkenyl, C₆-C₂₀-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{11B}₃, and the organic radicals R^{7B}-R^{10B} may also bear halogens or nitrogen or further C₁-C₂₀-alkyl groups, C₂-C₂₀-alkenyl groups, C₆-C₂₀-aryl groups, alkylaryl groups having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{5C}₃ as substituents and two vicinal radicals R^{7B}-R^{10B} may also be joined to form a five- or six-membered ring or at least one E^{1B}-E^{4B} is nitrogen;

- B) optionally an organic or inorganic support;
- C) optionally at least one activating compound; and

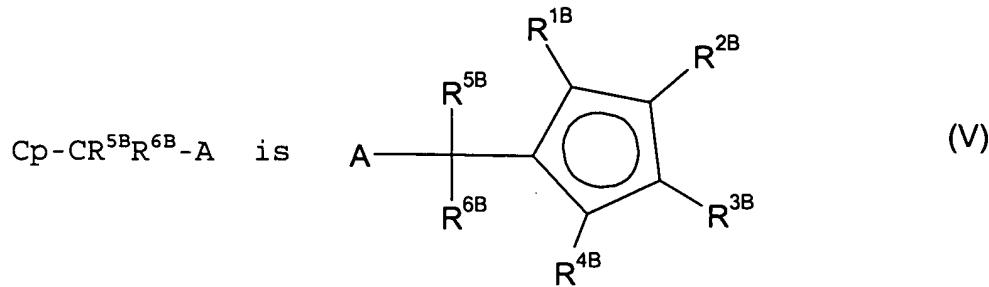
D) optionally at least one activating compound containing a metal of group 1, 2 or 13 of the Periodic Table;

and linear C₂-C₁₀-1-alkenes polymerized onto the catalyst system, wherein the catalyst system to polymer polymerized onto the catalyst system is in a mass ratio of from 1:0.1 to 1:200; and

wherein the prepolymerized catalyst system produces a copolymer of ethylene with α-olefins which comprises a molar mass distribution M_w/M_n of from 1 to 8, a density of from 0.85 to 0.94 g/cm³, a molar mass M_n of from 10 000 g/mol to 4 000 000 g/mol, a CDBI of less than 50%, the copolymer comprising at least a bimodal short chain branching distribution, and wherein a side chain branching of the maxima of the individual peaks of the short chain branching distribution, as determined by crystallization analysis fractionation (CRYSTAF), of the copolymer of ethylene and the α-olefins is greater than 5 CH₃/1 000 carbon atoms.

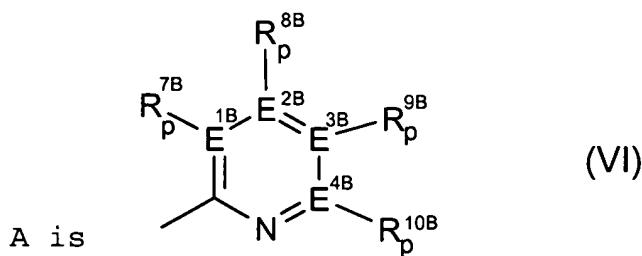
24. (New) A process comprising copolymerizing ethylene with α-olefins in the presence of a catalyst system comprising:

A') at least one monocyclopentadienyl complex A') comprising a structural feature of the formula (Cp-CR^{5B}R^{6B}-A)Cr (IV), where the variables have the following meanings:



where

$\text{R}^{1B}-\text{R}^{4B}$ are each, independently of one another, hydrogen, C_1-C_{20} -alkyl, C_2-C_{20} -alkenyl, C_6-C_{20} -aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl radical and 6-20 carbon atoms in the aryl radical, NR^{5A}_2 , $\text{N}(\text{SiR}^{11B}_3)_2$, OR^{11B} , OSiR^{11B}_3 , SiR^{11B}_3 , BR^{11B}_2 , where the organic radicals $\text{R}^{1B}-\text{R}^{4B}$ may also be substituted by halogens and two vicinal radicals $\text{R}^{1B}-\text{R}^{4B}$ may also be joined to form a five- or six-membered ring,
 $\text{R}^{5B}, \text{R}^{6B}$ are each hydrogen or methyl;



where

$\text{E}^{1B}-\text{E}^{4B}$ are each carbon or nitrogen,
 $\text{R}^{7B}-\text{R}^{10B}$ are each, independently of one another, hydrogen, C_1-C_{20} -alkyl, C_2-C_{20} -alkenyl, C_6-C_{20} -aryl, alkylaryl having from 1 to 10 carbon

atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{11B}_3 , where the organic radicals $\text{R}^{7B}-\text{R}^{10B}$ may also bear halogens or nitrogen or further C_1-C_{20} -alkyl groups, C_2-C_{20} -alkenyl groups, C_6-C_{20} -aryl groups, alkylaryl groups having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{11B}_3 as substituents and two vicinal radicals $\text{R}^{7B}-\text{R}^{10B}$ may also be joined to form a five- or six-membered ring,

R^{11B} are each, independently of one another, hydrogen, C_1-C_{20} -alkyl, C_2-C_{20} -alkenyl, C_6-C_{20} -aryl or alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part and two radicals R^{11B} may also be joined to form a five- or six-membered ring,

p is 0 when $\text{E}^{1B}-\text{E}^{4B}$ is nitrogen and is 1 when $\text{E}^{1B}-\text{E}^{4B}$ is carbon,

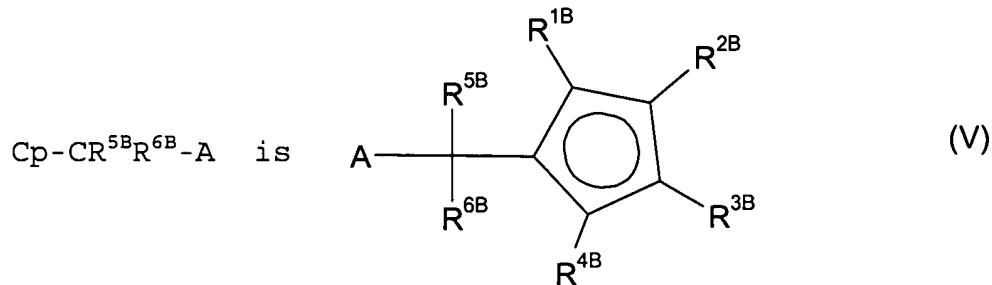
where at least one radical $\text{R}^{7B}-\text{R}^{10B}$ is C_1-C_{20} -alkyl, C_2-C_{20} -alkenyl, C_6-C_{20} -aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{11B}_3 , and the organic radicals $\text{R}^{7B}-\text{R}^{10B}$ may also bear halogens or nitrogen or further C_1-C_{20} -alkyl groups, C_2-C_{20} -alkenyl groups, C_6-C_{20} -aryl groups, alkylaryl groups having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{5C}_3 as substituents and two vicinal radicals $\text{R}^{7B}-\text{R}^{10B}$ may also be joined to form a five- or six-membered ring or at least one $\text{E}^{1B}-\text{E}^{4B}$ is nitrogen;

B) optionally an organic or inorganic support;
C) optionally at least one activating compound; and
D) optionally at least one metal compound containing a metal of group 1, 2 or 13 of the Periodic Table;
wherein the process produces a copolymer of ethylene with α -olefins which comprises a molar mass distribution M_w/M_n of from 1 to 8, a density of from 0.85 to 0.94 g/cm³, a molar mass M_n of from 10 000 g/mol to 4 000 000 g/mol, a CDBI of less than 50%, the copolymer comprising at least a bimodal short chain branching distribution, and wherein a side chain branching of the maxima of the individual peaks of the short chain branching distribution, as determined by crystallization analysis fractionation (CRYSTAF), of the copolymer of ethylene and the α -olefins is greater than 5 CH₃/1 000 carbon atoms.

25. (New) A process for preparing a copolymer of ethylene with α -olefins which comprises a molar mass distribution M_w/M_n of from 1 to 8, a density of from 0.85 to 0.94 g/cm³, a molar mass M_n of from 10 000 g/mol to 4 000 000 g/mol, a CDBI of less than 50%, the copolymer comprising at least a bimodal short chain branching distribution, and wherein a side chain branching of the maxima of the individual peaks of the short chain branching distribution, as determined by crystallization analysis fractionation (CRYSTAF), of the copolymer of ethylene and the α -olefins is greater than 5 CH₃/1 000 carbon atoms, the process comprising

polymerizing ethylene with α -olefins in presence of a catalyst system comprising:

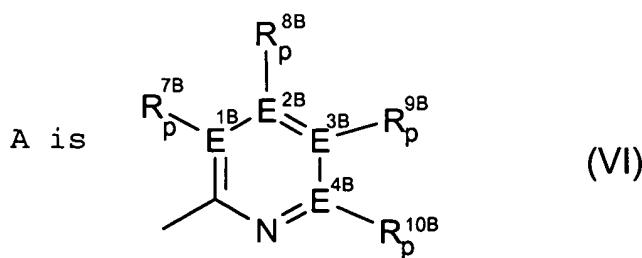
A') at least one monocyclopentadienyl complex A') comprising the structural feature of a formula (Cp-CR^{5B}R^{6B}-A)Cr (IV), where the variables have the following meanings:



where

R^{1B}-R^{4B} are each, independently of one another, hydrogen, C₁-C₂₀-alkyl, C₂-C₂₀-alkenyl, C₆-C₂₀-aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl radical and 6-20 carbon atoms in the aryl radical, NR^{5A}₂, N(SiR^{11B}₃)₂, OR^{11B}, OSiR^{11B}₃, SiR^{11B}₃, BR^{11B}₂, where the organic radicals R^{1B}-R^{4B} may also be substituted by halogens and two vicinal radicals R^{1B}-R^{4B} may also be joined to form a five- or six-membered ring,

R^{5B}, R^{6B} are each hydrogen or methyl;



where

$E^{1B}-E^{4B}$ are each carbon or nitrogen,
 $R^{7B}-R^{10B}$ are each, independently of one another, hydrogen, C_1-C_{20} -alkyl, C_2-C_{20} -alkenyl, C_6-C_{20} -aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{11B}_3 , where the organic radicals $R^{7B}-R^{10B}$ may also bear halogens or nitrogen or further C_1-C_{20} -alkyl groups, C_2-C_{20} -alkenyl groups, C_6-C_{20} -aryl groups, alkylaryl groups having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{11B}_3 as substituents and two vicinal radicals $R^{7B}-R^{10B}$ may also be joined to form a five- or six-membered ring,

R^{11B} are each, independently of one another, hydrogen, C_1-C_{20} -alkyl, C_2-C_{20} -alkenyl, C_6-C_{20} -aryl or alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part and two radicals R^{11B} may also be joined to form a five- or six-membered ring,

p is 0 when $E^{1B}-E^{4B}$ is nitrogen and is 1 when $E^{1B}-E^{4B}$ is carbon,

where at least one radical $R^{7B}-R^{10B}$ is C_1-C_{20} -alkyl, C_2-C_{20} -alkenyl, C_6-C_{20} -aryl, alkylaryl having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon atoms in the aryl part or SiR^{11B}_3 , and the organic radicals $R^{7B}-R^{10B}$ may also bear halogens or nitrogen or further C_1-C_{20} -alkyl groups, C_2-C_{20} -alkenyl groups, C_6-C_{20} -aryl groups, alkylaryl groups having from 1 to 10 carbon atoms in the alkyl part and 6-20 carbon

atoms in the aryl part or SiR^{SC} , as substituents and two vicinal radicals $\text{R}^{\text{7B}}-\text{R}^{\text{10B}}$ may also be joined to form a five- or six-membered ring or at least one $\text{E}^{\text{1B}}-\text{E}^{\text{4B}}$ is nitrogen;

- B) optionally an organic or inorganic support;
- C) optionally at least one activating compound; and
- D) optionally at least one metal compound containing a metal of group 1, 2 or 13 of the Periodic Table.

26. (New) The process as claimed in claim 25, wherein the polymerization is carried out using, as monomers, a monomer mixture which comprises at least one of ethylene and $\text{C}_3\text{-C}_{12}$ -1-alkenes and contains at least 50 mol% of ethylene.

27. (New) A polymer mixture comprising

- (E) from 1 to 99% by weight of at least one ethylene copolymer comprising a molar mass distribution M_w/M_n of from 1 to 8, a density of from 0.85 to 0.94 g/cm³, a molar mass M_n of from 10 000 g/mol to 4 000 000 g/mol, a CDBI of less than 50%, the copolymer comprising at least a bimodal short chain branching distribution, and wherein a side chain branching of the maxima of the individual peaks of the short chain branching distribution, as determined by crystallization analysis fractionation (CRYSTAF), of the ethylene copolymer is greater than 5 $\text{CH}_3/1\ 000$ carbon atoms;

and

(F) from 1 to 99% by weight of a polymer which is different from (E),

where the percentages by weight are based on the total mass of the polymer mixture.

28. (New) A fiber, film or molding comprising an ethylene copolymer comprising a molar mass distribution M_w/M_n of from 1 to 8, a density of from 0.85 to 0.94 g/cm³, a molar mass M_n of from 10 000 g/mol to 4 000 000 g/mol, a CDBI of less than 50%, the copolymer comprising at least a bimodal short chain branching distribution, and wherein a side chain branching of the maxima of the individual peaks of the short chain branching distribution, as determined by crystallization analysis fractionation (CRYSTAF), of the ethylene copolymer is greater than 5 CH₃/1 000 carbon atoms.
29. (new) The process of claim 20 where L is carbon.